



WORKING PAPER

FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

- Agenda Item 2: Timely and safe use of new technologies**
2.1: Evolving aircraft technologies contributing to LTAG

**ENHANCING REGULATORY FRAMEWORK
FOR ELECTRIC AND HYBRID AIRCRAFT OPERATIONS**

(Presented by the Republic of Korea)

EXECUTIVE SUMMARY

This paper underscores the importance of a global regulatory framework aligned with the current trends in electric and hybrid aircraft development. As the aviation industry progresses towards integrating electric and hybrid propulsion into existing aircraft, it is critical to review existing regulatory frameworks to effectively facilitate this transition.

This working paper highlights the urgent need for updated regulatory frameworks to ensure the safe commercialization of electric and hybrid aircraft. It emphasizes the necessity of establishing global standard and fostering international coordination to promote industry sustainability.

Action: The Conference is invited to:

- a) encourage Member States to recognize the arrival of electric and hybrid aircraft, share lesson learned and support ICAO in prioritizing this issue as a key initiative; and
- b) recommend that ICAO establish clear objectives and timelines for the review and revision of relevant Standards and Recommended Practices (SARPs) to accommodate the unique requirements of electric and hybrid aircraft.

1. INTRODUCTION

1.1 Legacy aircraft are powered by conventional aviation fuel, which significantly exacerbates to carbon emissions and atmospheric pollution. In response to these environmental concerns, the aviation industry has been actively developing low-carbon technologies. Consequently, electric and hybrid propulsion systems have been in development for an extended period. Electric or hybrid aircraft offer the potential to substantially reduce carbon emissions compared to legacy aircraft, making them a promising alternative for cleaner and more sustainable aviation.

1.2 While the development of newly introduced electric Vertical Take-off and Landing (eVTOL) aircraft is active, significant research and development efforts are also focused on retrofitting existing aircraft platforms with electric and hybrid propulsion systems, known for their environmentally

friendly nature. With substantial technological advancements underway, electric and hybrid aircraft are expected to rapidly commercialize, leveraging areas that closely aligned with existing regulations.

1.3 The purpose of this paper is to address the emerging phase where electric or hybrid propulsion systems are being integrated into legacy aircraft, highlighting the need to consider how current regulatory frameworks can be effectively applied. It urges proactive preparation to anticipate and facilitate this transition smoothly.

2. DISCUSSION

2.1 According to the dashboard of current status of electric and hybrid aircraft development on ICAO website¹, the current trends in electric and hybrid aircraft development indicate a greater emphasis on converting existing aircraft to electric and hybrid propulsion systems compared to eVTOL. Electric and hybrid aircraft are well-positioned to benefit from the existing regulatory frameworks. Converting the propulsion systems of legacy aircraft suggests a more streamlined development pathway compared to eVTOL. Furthermore, leveraging existing infrastructure such as corridors and airports can expedite the commercialization process. While there may be variations in criteria, such as airworthiness standards and contingency fuel requirements, these can generally be accommodated within current regulations, facilitating accelerated deployment.

2.2 Due to these advantages, modifying existing aircraft into electric and hybrid models promises faster commercial deployment compared to eVTOL projects, playing a crucial role in enhancing the sustainability of the aviation industry. This approach has driven extensive research and development within the industry, accelerating the transition towards electric and hybrid aircraft.

2.3 To ensure effective operation of electric and hybrid aircraft, it is essential to reassess the current regulatory frameworks, which currently have shortcomings in several areas. Addressing this issue requires a comprehensive gap analysis of existing regulations to establish new operational and safety standards. The prevailing aviation regulations predominantly cater to traditional fossil fuel-powered aircraft, often struggling to accommodate the unique features of electric and hybrid aircraft. Therefore, a thorough evaluation of current regulations concerning the operation, safety, and maintenance of electric aircraft is imperative. Furthermore, the development of new standards addressing elements such as power supply, charging infrastructure, battery management, and other specific requirements is essential for the successful integration of electric and hybrid aircraft into the aviation sector.

2.4 The urgent establishment of these regulatory frameworks is crucial to accelerate the commercialization of electric and hybrid aircraft. In the absence of regulations that can effectively accommodate new technologies and operational models, the safe introduction and operation of electric and hybrid aircraft pose significant challenges. The prompt development of international standards will not only facilitate the commercialization of electric aircraft but bolster the sustainability of the aviation industry. This requires collaborative efforts to establish coherent global standards, ensuring seamless adoption by national civil aviation authorities. The industry is now at the precipice of a technological revolution, with the imminent commercialization of electric and hybrid aircraft driven by substantial readiness and advancements.

2.5 While discussions on the commercialization of electric and hybrid aircraft are already taking place across various ICAO panels, it is imperative that efforts are integrated and not isolated. Progress in one domain alone is insufficient. To guarantee the successful commercialization of electric

¹ <https://www.icao.int/environmental-protection/Pages/electric-aircraft.aspx>

aircraft, it is essential to establish a comprehensive timeline and common objectives that all domains can collectively strive towards.

2.6 Nonetheless, it is imperative that these efforts are harmonized and guided by a common objective. This includes setting a clear timeline for commercialization and ensuring active participation from all relevant domain experts to realize this objective. A coordinated approach will facilitate the development of cohesive regulations, safety standards, and operational protocols necessary for the widespread adoption of electric and hybrid aircraft.

2.7 By aligning the efforts of all domains and establishing a shared timeline, ICAO can better equip itself to tackle the challenges and capture opportunities presented by electric and hybrid aircraft. This coordinated effort will help in addressing regulatory gaps, ensuring safety, and promoting international standardization, ultimately paving the way for the successful commercialization of electric and hybrid aircraft.

3. **CONCLUSION**

3.1 The aviation sector is strategically advancing the commercialization of electric and hybrid aircraft to reduce carbon emissions and bolster sustainability initiatives. Despite ongoing discussions and preparations across multiple ICAO channels, there remains a pressing need for concerted efforts to ensure swift implementation. It is important to set clear objectives and readiness to promptly revise SARPs within existing regulatory frameworks to safely and effectively integrate electric and hybrid aircraft. Furthermore, fostering collaboration among international aviation authorities is pivotal for establishing cohesive global standards and targeted timelines.

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